EDWA Dipole Magnet

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EDWA magnet is designed to generate 3.38 T· m integrated stationary dipole magnetic field. Pole profile configuration is optimized for 1.12 Tesla field in the air gap to provide the maximum width of a good field area. Because of strong magnet width restrictions, a solid core was chosen as more economic solution. The magnet is capable generate higher field up to 1.3 Tesla with field quality ± 0.1 % in smaller area ± 1". Each magnet should be calibrated with help to end shims to eliminate end field and manufacturing distortions.

Table 1

Magnet integrated field, T x m	3.38		
Magnet air gap	50.8 mm (2")		
Magnet core width	460 mm (18.3")		
Magnet core height	432 mm (17")		
Magnet core length	3.048 m (120")		
Maximum field at currents 823 A	1.12 T		
1000 A	1.23 T		
1100 A	1.29 T		
Field homogeneity in middle plane at± 38mm(1.5")	± 0.1 % (823 A)		
Nominal Current, A	823	1000	1100
Voltage drop, V	30	36	40
Power, kW	24.7	36	44
Number of water circuits	6		
Conductor (0.635"x0.635" d=1/4")	16.1mm d=6.35mm		
Number of coils	2		
Number of sections in the coil	3		
Number of turns in the magnet	60		
Water pressure drop, bar	4		
Water flow, l/min	15.5		
Water temperature rise, °C	23	34	41
Conductor weight, kg	850		
Core weight, kg	3400		
Magnet weight, kg	4300		

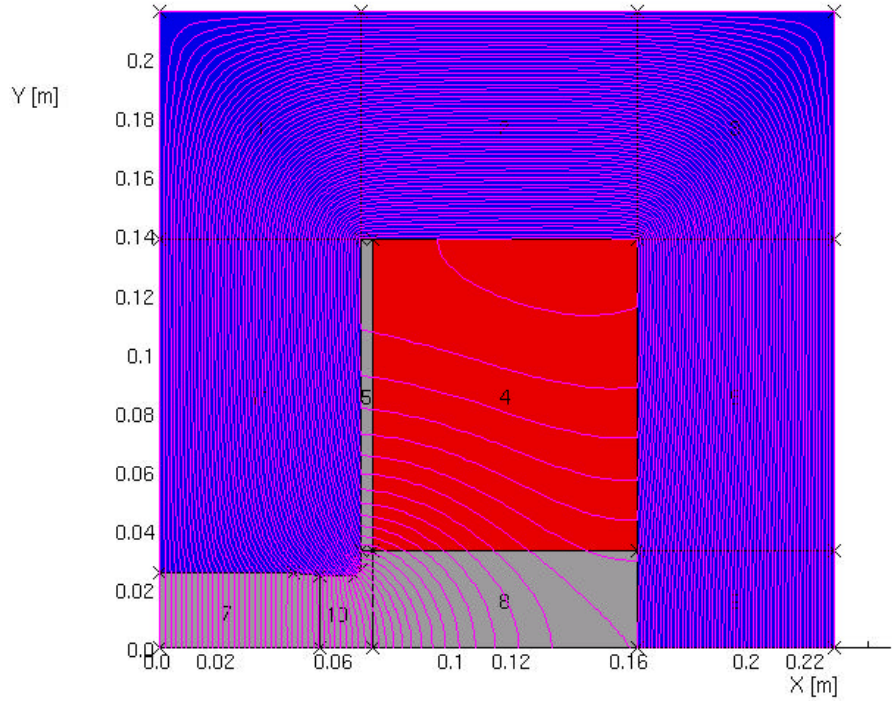

Fig. 1 Magnet cross-section and flux lines

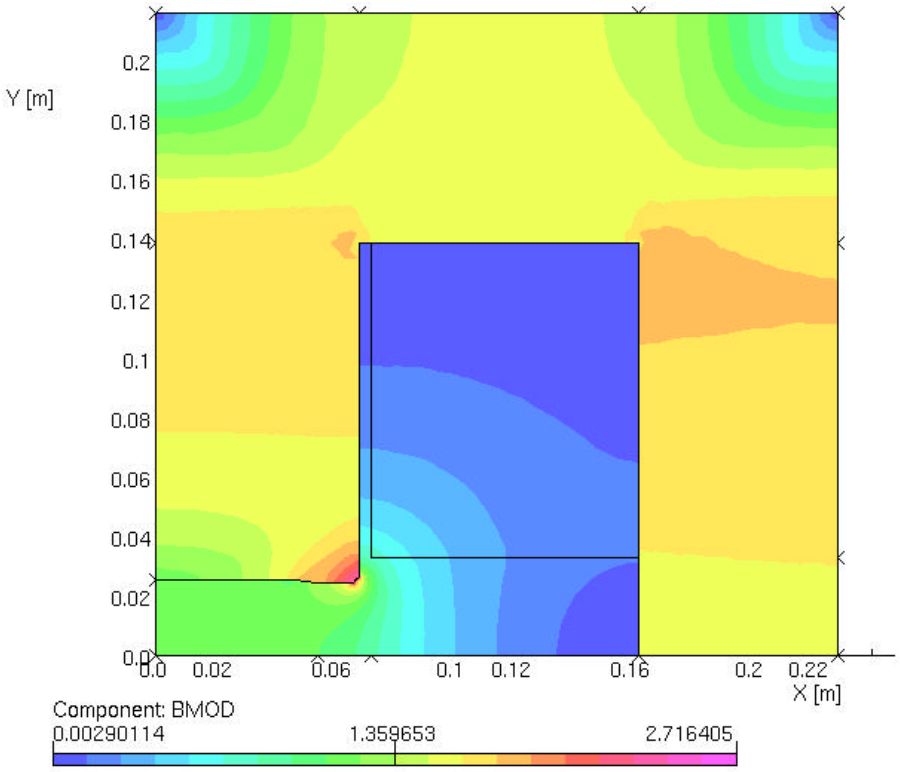

Fig. 2 Magnet cross-section and flux density

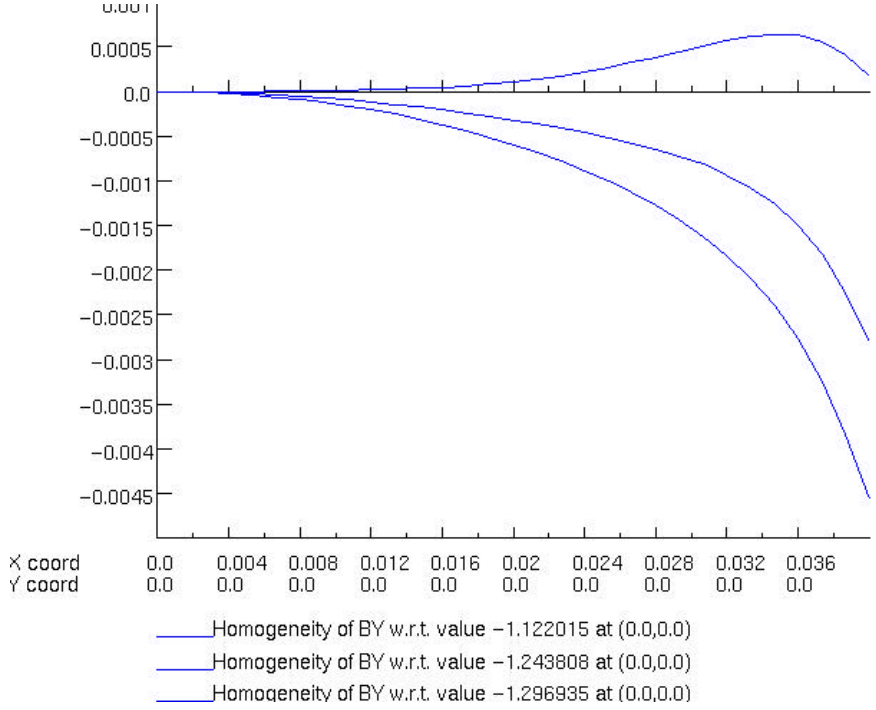

Fig.3 Field distribution in magnet median plane at I=823A, 1000A, 1100, Steel ARMCO

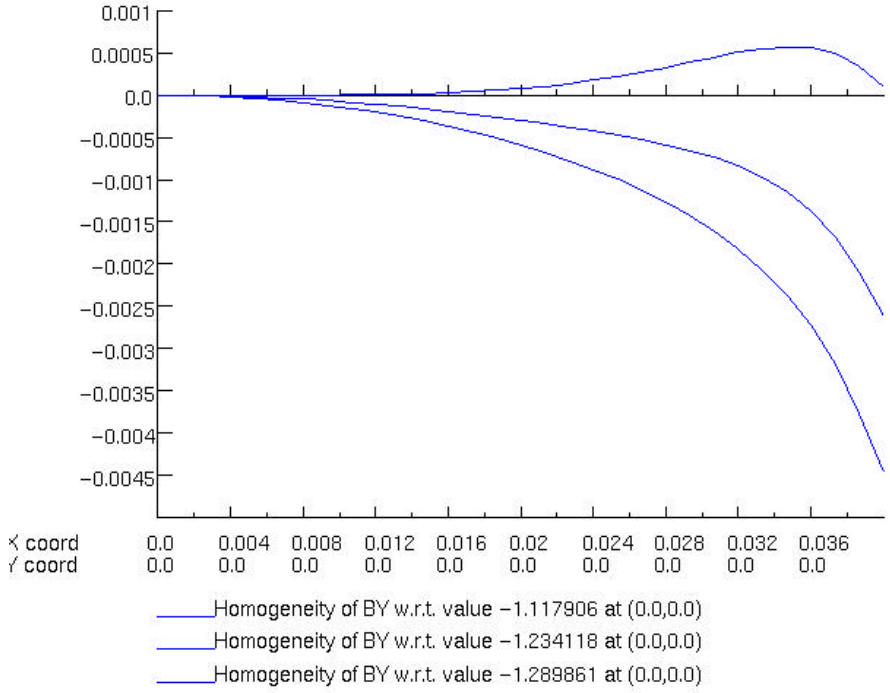

Fig.4 Field distribution in magnet median plane at I=823A, 1000A, 1100A Steel AISI 1010

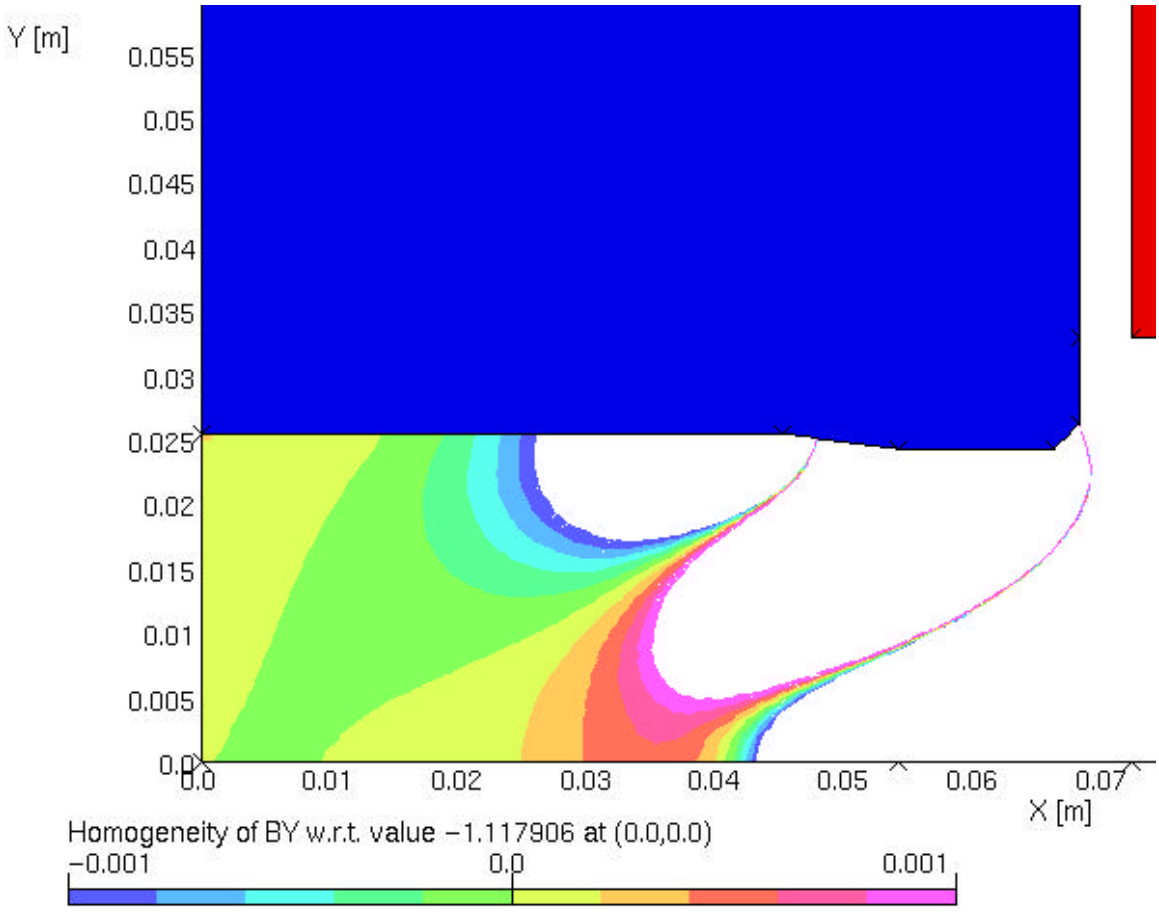

Fig. 5 Field homogeneity in air gap at I=823 A

Magnet core is saturated and steel magnetic properties have strong influence on the field value and its quality. That is why recommended procedure is:

- order the steel type AISI 1006-1008;
- measure the magnetic properties of the steel ;
- recalculate the field and if need correct the pole profile (see Appendix);
- correct the drawings;
- measure the magnetic field by rotational coil and stretch wire;
- calibrate the magnet effective length and correct high order field components by end shims.

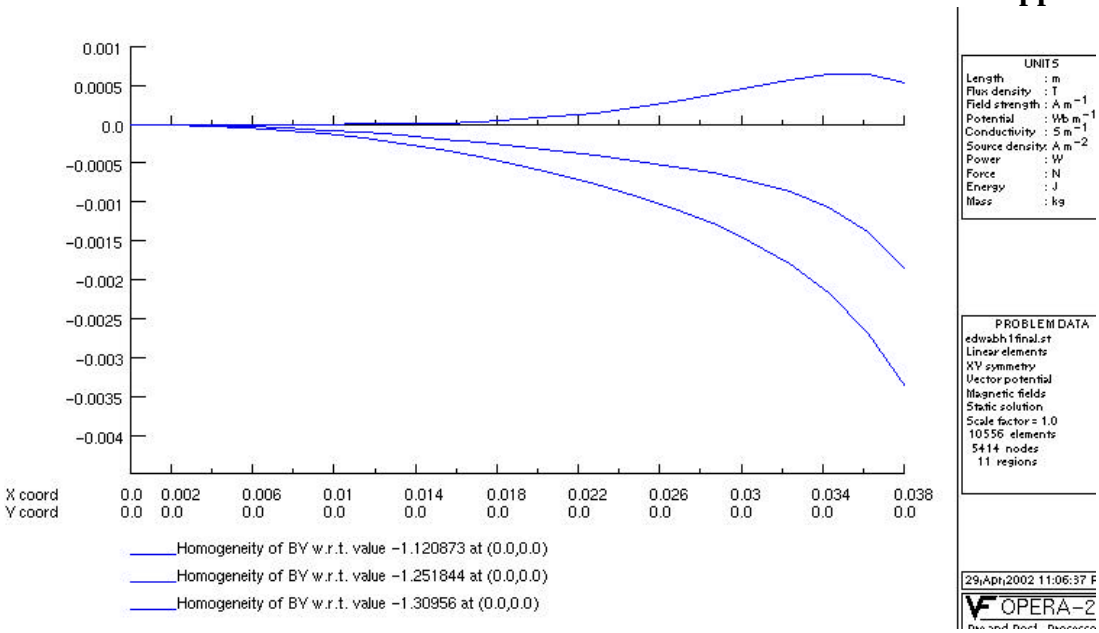

Fig. 6 Field distribution at 823 A, 1000 A, 1100 A. Steel sample 1

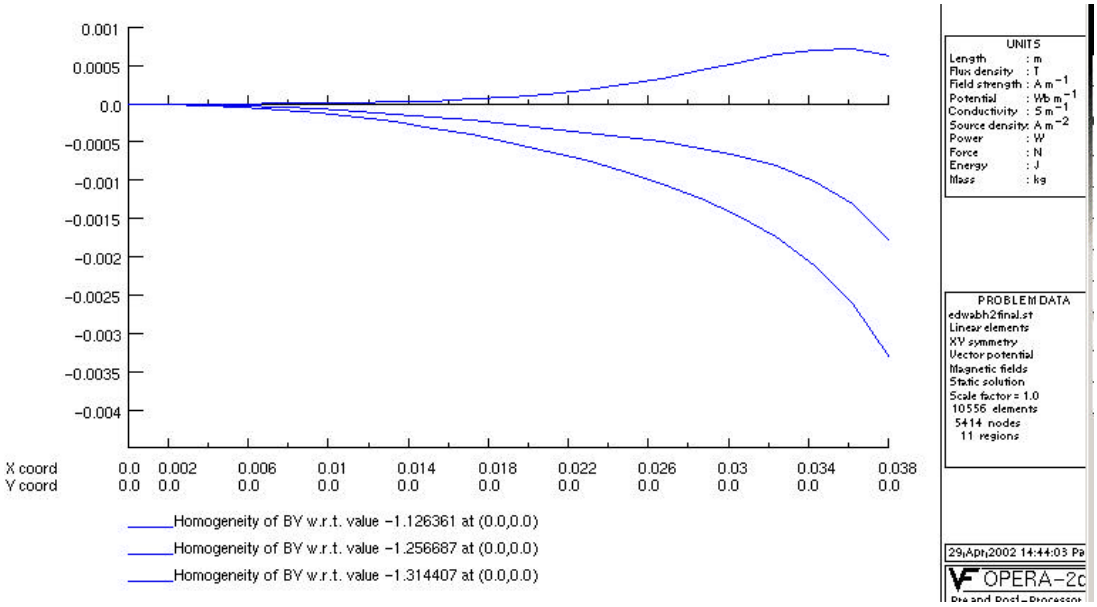

Fig. 7 Field distribution at 823 A, 1000 A, 1100 A. Steel sample 2(best case)

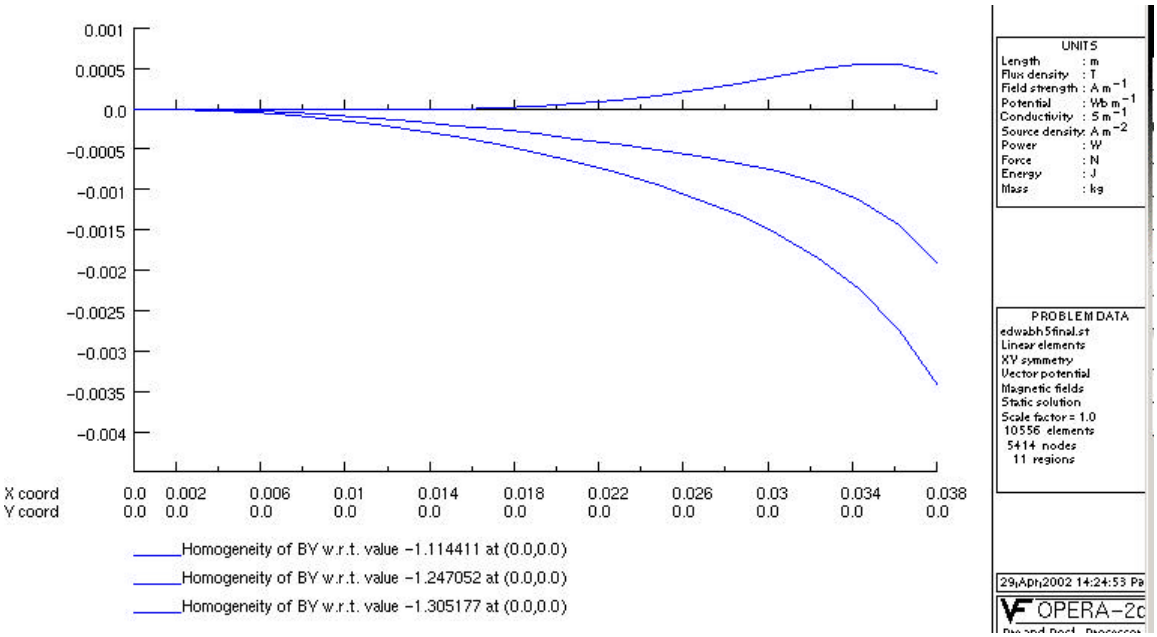

Fig. 8 Field distribution at 823 A, 1000 A, 1100 A. Steel sample 5 (worse case)

Summary

Five EDWA magnets were manufactured and tested. Steel ring samples were taken from each pole steel plate and B-H curves measured. The results of calculations with real steel properties are shown in Appendix. They are in good agreement with previous calculations and design parameters. As a result, the pole profile and magnet dimensions were not changed after the first prototype magnet test.